Climate Change and its Impacts on Older Adults' Health in Kazakhstan

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Abstract

There has been growing concern over climate change and its impacts on many aspects of human society, particularly on health. Climate change may affect health in a wide range of forms: increased floods and droughts, increased frequency and intensity of heat waves, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition (Haines et al. 2006b). So far, little is known about climate change and its impacts on older adults' health in Central Asia, particularly in Kazakhstan, where a downturn of life expectancy has been prevalent. The objective of this paper is to examine the impacts of climate change on older adults' health in Kazakhstan. Based on the literature review and empirical evidence, this study concludes that climate change largely affects older adults' health in Kazakhstan. This study emphasizes that older adults are becoming increasingly aware of the climate-change risks and its impacts on human health. Older adults are matured human capital of any society and can be utilized to address the climate-related health consequences in the twenty-first century. It is hoped that the findings of this study will have enormous policy implications.

Keywords: Climate change; health; Kazakhstan; older adults.

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Introduction and Setting the Context

It is widely recognized in the scientific community that Earth's climate system has evidently changed since the pre-industrial era and will continue to change in the coming centuries at rates projected to be unprecedented in recent human history (Adger et al. 2003; Costello et al. 2009; Epstein and Mills 2005; WHO 2003; Zhang, Bi and Hiller 2008). The 2001 Intergovernmental Panel on Climate Change (IPCC) observed that humans had been contributing to this change in a range of sectors such as power generation, transport, built environment and agriculture and land use to the increasing concentrations of greenhouse gases (GHG) in the atmosphere (Haines 2008; McMichael et al. 2008). As an effect, Epstein (2007) argues that weather has become more extreme, and biological systems on all continents and in the oceans are responding to the warming. Therefore, climate change becomes a global concern among the scientific community as well as policy-makers. Its impacts on the ecosystem and human health were highlighted on World Health Day 2008 with the theme entitled "protecting health from climate change" (Wirawan 2010). Climate change is one of the most pressing environmental challenges facing humanity with strong relevance to food security, health, natural ecosystems, freshwater supply, secure shelter and social relations. On average, 1 out of 19 in a developing country will be hit by a climate disaster, compared to 1 out of 1,500 in an OECD country (Mohammed 2008). In 1988, for example, Hurricane Mitch dropped six feet of rain on Central America in three days. In its wake, it left malaria, dengue fever, cholera, and leptospirosis soaring (Epstein and Mills 2005). In 2000, rain and three cyclones inundated Mozambique for six weeks, and the cases of malaria rose five-fold (Epstein 2005). In 2003, a summer heat wave in Europe killed tens of thousands of people, 14,802 deaths in a 20-day period alone in France (Kovats and Hajat 2008), also wilted crops, set forests ablaze, and melted 10 % of the Alpine glacial mass (Epstein 2005). Kovats and Akhtar (2008) and Patil and Deepa (2007) opine that some of the health effects may intensify if the increase in very extreme weather continues. As a result, extreme weather events not only have a profound impact on public health, as shocks may also ripple through global economies, particularly in developing countries. For example, Hurricane Mitch killed more than 11,000 people and caused damage exceeding 5 billion US dollars (Epstein 1999). Research shows that more subtle, gradual climatic changes also can damage human health (Campbell-Lendrum et al. 2009; Cockerham et al. 2006; Haines 2008; Jay and Marmot 2009). During the past two decades, the prevalence of asthma in the United States has quadrupled, in part because of climate-related factors. For Caribbean islanders, respiratory irritants come in dust clouds that emanate from Africa's expanding deserts and then sweep across the Atlantic by trade winds accelerated by the widening pressure gradients over warming oceans (Epstein 2005). The 2009 dust storm in Sydney also caused many health problems for children, pregnant women and older adults (ABC News 2009). All these have contributed serious challenges

to human habitability, making human populations the most vulnerable across the world. As a consequence, Kazakhstan, a Central Asian country, is not out of it and suffers from adverse effects of climate change.

The climate of Kazakhstan is continental. There is growing concern over the consequences of increased emissions of CO2 and other GHGs due to anthropogenic activities and associated climate change in Kazakhstan (Doroshin 2008; Pilifosova, Eserkepova and Dolgih 1997). The GHG inventory in Kazakhstan shows that the 2005 GHG emissions with a direct greenhouse effect amounted to 240.7 million tons of CO2 equivalent (Perelet 2007; Perelet 2008). Trend and correlation analysis for the period from 1879 to 2000 at 16 climate stations in the Tien Shan mountains (Kazakhstan/Kyrgyzstan) showed a temperature increase, which has become pronounced since the 1950s (Bolch 2007). The trend coefficient was about 0.8K/100a for the period 1900 to 2000 and about 2.0K/100a on average for the second half of the last century (Bolch 2007). The increase was about two times higher than the global average in Northern Tien Shan from 1950 to 2000, where it was mainly due to a rise of temperature (Bolch 2005; Bolch 2007). One of the anticipated outcomes of global warming is a projected increase in glacial melt, leading to increased flows in some river systems for a few decades, followed by a reduction in flow as the glaciers disappear (Glantz 2005). In Kazakhstan, as in other parts in Central Asia, glaciers and ice-rich permafrost serve as water towers, providing a continuous supply of fresh water to the lowlands and thereby allowing economic activity to take place (Harrison 2005a). In the Northern Tien Shan range in Kazakhstan, glacier retreat affects the nature of the natural hazards in the populated valleys and the lowland piedmont zone. Harrison (2005b) illustrates that the glacier recession has at least two major consequences on human health and the environment. First, the retreat of glaciers has uncovered a huge amount of unconsolidated glacial debris now choking main and tributary valleys. During periods of heavy rain, these are remobilized and form destructive debris flows that travel rapidly down valley into the Southern suburbs of Almaty. Second, and even more importantly, glacier retreat has led to the development of glacial lakes dammed by unstable moraines. These lakes drain catastrophically, and the subsequent debris flows pose a significant natural hazard to Almaty city. One of the most powerful debris flows to affect the Northern valleys of the Tien Shan occurred in July 1973 in the Malaya Almatinka valley (Harrison 2005b). This deposited four million cubic meters of debris into the large dam and storage reservoir above Almaty (Harrison 2005a). As a result, Kazakhstan needs to urgently address climate-change effects.

Older adults are among the groups most at risk due to decreased mobility, changes in physiology and more limited access to resources. These may limit the adaptive capacity of elderly people and other vulnerable groups. Filiberto et al. (2009) indicate that vulnerable populations will face adaptive challenges to their new environments, with potentially far-reaching implications for health as well as for societal strategies to cope with climate-change effects on both the population

and policy perspective. In recent times, Kazakhstan has experienced unprecedented hot waves in the summer and deep cold spells in the winter, leaving hundreds in serious health trauma. Of them, children and the elderly suffer the most in the event of human-induced natural whims (for details, see Crighton et al. 2011).

The key objective of this paper is to examine the potential impacts of climate change on the older adults' health in Kazakhstan. In doing so, this study reviews a comprehensive global landscape of the association between climate change and human health with a particular emphasis on Kazakhstan and its older population. In recent years, there has been a lack of critical understanding among scientific communities, policy-makers and stakeholders about the extent to which climate change may affect our lives and livelihoods. As of yet, very little is known as to the people's perception about climate change and its consequences on health. In this context, there is also a lack of evidence-based study in the literature and methodological challenges too in researching this issue (Xun et al. 2010). This study will contribute to fill out the deplorable research gap now existing in this growing field of scientific inquiry.

This article is divided into five sections. The first section proceeds by introducing the context in which the older adults' health in Kazakhstan is perceived to be affected by climate change. In the following two sections, the conceptual framework of the study will be presented, and data collection strategy and methods will be discussed. Next, an association between climate change and older adults' health in Kazakhstan is addressed from a multifaceted perspective, and the results of the study are reported. The final section concludes the paper and highlights policy implications indicating the limitations of the study and issues for future research.

Conceptual framework

There is growing evidence that climate change will have enormous implications for human health (Ahsan 2009; Haines et al. 2006a; Haines et al. 2006b; Kalkstein and Smoyer 1993; Louis and Hess 2008; Patz et al. 2005; Shuman 2010; WHO 2003; Woodward et al. 1998). The Lancet and University College of the London Institute for Global Health Commission recognized that rapid changes of weather patterns with increased numbers of extreme weather events are impacting the health of the vulnerable population (Costello et al. 2009; Grasso et al. 2010; Rahman 2008). A 2002 World Health Organization (WHO) report estimated that climate change was considered to be responsible for approximately 2.4 % of worldwide diarrhea and 6 % of malaria in some middle-income and 7 % of dengue fever in some industrialized countries in 2000 (WHO 2003). Globally, the mortality rate attributable to climate change that had already occurred was estimated at 154,000 (0.3 %) deaths per year, and the annual attributable burden was 5.5 million (0.4 %) disability-adjusted life years, with the greatest proportion burden in sub-Saharan Africa and South Asia

(Louis and Hess 2008; WHO 2002). There are some widely cited examples suggesting that climate change has already resulted in the introduction of infectious diseases into previously unaffected geographical areas. One such example is the spread of malaria into highland regions of East Africa, where this disease previously did not exist (Shuman 2010). The retreat of glaciers in the mountain regions creates environmental hazards, which affect millions of lives across the world (Harrison 2005a). These events clearly demonstrate that climatic changes pose serious health risks in the poorest countries such as undernutrition, inadequate and unsafe water, poor-quality nutrients, incidents of weeds, insects and diseases and the burning of low-quality fuels for household use – all of which exhibit significant climate sensitivity (Rosenzweig et al. 2001; WHO 2007; WHO 2002). Table 1 gives a glimpse on examples of vector-borne diseases likely to be sensitive to climate change.

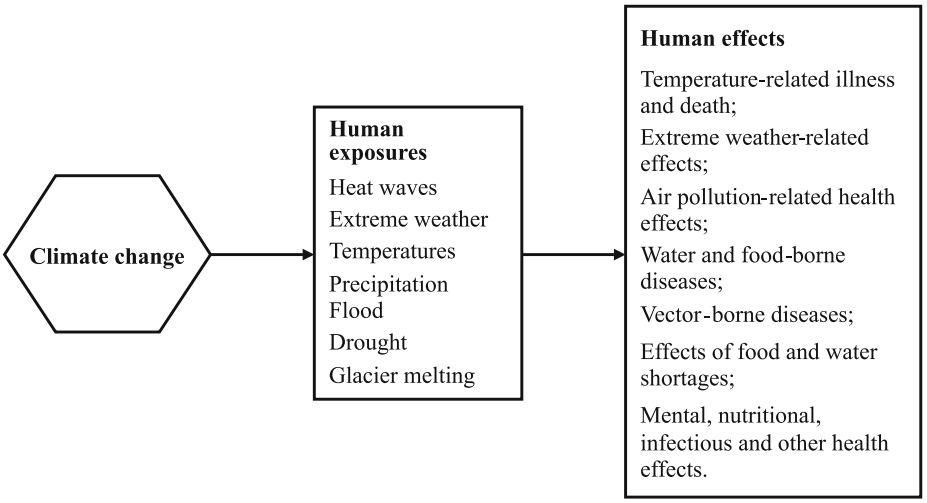
Table 1
Vector-borne diseases likely to be sensitive to climate change

Vector	Major diseases
Mosquitoes	Malaria, filariasis, dengue fever, yellow fever and West Nile fever
Sandflies	Leishmaniasis
Triatomines	Chagas disease
Ixodes ticks	Lyme disease and tick-borne encephalitis
Tsetse flies	African trypanosomiasis
Blackflies	Onchocerciasis
Snails (intermediate host)	Schistosomiasis

Source: Haines et al. 2006b, 590.

The changes in global climate have both direct and indirect impacts on human health. The direct effects include injury and illness due to the more frequent heat waves, floods and droughts expected as a result of higher temperatures, extremes of rainfall and thermal expansions of oceans (Haines et al. 2006a; Woodward et al. 1998). For example, populations that have experienced flooding suffer sustained increases in common mental disorders (Ahern et al. 2005). According to the UN IPCC: "Many millions more people are projected to be flooded every year due to sea-level rise by the 2080s" (IPCC 2007). Indirect effects are mediated via the influence of climate change on biological systems such as disease-carrying vectors or productive agro-ecosystems or other aspects of the physical environment (for example, photochemical oxidants) (Woodward et al. 1998). But the actual health impacts are largely dependent on local environmental conditions and socioeconomic circumstances (IPCC 2001). A conceptual framework used for the analysis of the impact of climate change on health is presented in Figure 1.

Figure 1
Pathways by which climate change affects human health.



Source: Partially modified from WHO 2003, 11.

Data and methods

Data for this study have been collected by employing both primary and secondary sources. As regards secondary sources, this paper, following Webster and Watson (2002), emphasizes literature review. To this end, three sources have been explored and analyzed: first, published research in the forms of academic journals, books, newspaper articles related to climate change and health, particularly focusing on older adults' health; second, reports and policy documents that have been published by numerous agencies such as the international development organizations and the Government of Kazakhstan (GoK) on climate change and older adults' health; and third, websites of various public and non-government organizations in Kazakhstan as well as international and regional development organizations that provide information to make people aware of potential challenges that emanate from climate change as it impacts on the health of older adults.

Primary data were collected to substantiate the secondary data and mainly derived from month-long interviews conducted in May 2010. By administering a semi-structured questionnaire, the first of the present authors, supported by two bilingual (Russian and English) research assistants, interviewed a total of 60 people, who were carefully chosen from five micro-districts in Almaty city: Bostandykskiy, Medeuskiy, Auezovskiy, Turksibskiy and Almalinskiy (see Table 2 for the characteristics of the respondents). Two specific criteria were considered for the selection of

the respondents: age not below 40 years and continuously living in Kazakhstan for 10 years or more. The importance of these criteria is two-fold in the context of this research: first, it is widely recognized that various ageing-related diseases gradually appear after one attains the age of 40 years; second, it is assumed that if a person continuously lives in a place for 10 years or more, they may gain considerable knowledge and understanding about the country's climate and could also be able to notice if any change occurs.

Variables used in the analysis

Variables considered in the study have been classified into three categories: (i) demographic; (ii) socioeconomic; and (iii) awareness (climate change and health). The covariates are briefly discussed below:

Demographic variables

Two demographical variables are examined in the analysis. These are:

(1) The age of the respondents at the time of the interview (in completed years). The respondents have been classified into two groups on the basis of their age, i.e. below 50 years (40–49 age cohort) and 50 years and above (50+ age cohort). It is understood that the age of the respondents is an important factor to understand climatic change and its impacts on health.

(2) Gender is another demographic variable considered in the study. An emphasis is placed on this variable because gender has been found to be important in climate change research (UN 2008).

Socioeconomic variables

The following two socioeconomic variables are considered in the analysis:

(1) Education: In this study, education is defined as the dichotomy of secondary and tertiary levels of education. Primary education has not been taken into consideration because Kazakhstan's 1995 constitution provides mandatory secondary school education for its citizens. It has been increasingly recognized in recent studies (e.g. Kagawa and Selby 2009; Leal Filho et al. 2007) that education can play a key role in supporting efforts towards addressing climate change.

(2) Monthly income of the respondents: It is directly correlated to health care and adaptation to climate change. Moser and Satterthwaite (2008) emphasize the importance of this issue. In this study, after reviewing the average monthly salary of sectors in Kazakhstan, such as agriculture, fishing, mining, transport and communications, real estate and public agencies (see Arinova 2009), the respondents were classified into two income groups: <40,000 Tenge[3] and >40,000 Tenge.

3 Tenge is the name of the currency of Kazakhstan. 1 USD = 147.50 Tenge as of 26 September 2010.

Awareness variables

Studies (e.g. Anderson 2009; Boykoff and Goodman 2009; Sampei and Aoyagi-Usui 2009) show that awareness of the climate-change phenomenon leads to significant behavior change amongst individuals, groups and corporate managers. In particular, the awareness of health effects of climate change has significantly impacted individuals taking up the cause to lead climate change campaigns to counter its onslaught (Halady and Rao 2010). Three variables relating to awareness are examined; these are:

(1) Change in the environment of the living place. In order to understand whether or not the respondents were aware of any environmental change, they were asked, during the survey, the following question; "Do you see any changes in the environment of your living place due to climate changes' impact?" Three types of answers were recorded (yes, no and do not know). In case of positive answers, the respondents were then asked to pick three major changes they consider important from a given five choices, which were coded as follows: factor 1: hot waves in summer, factor 2: deep cold spells in winter, factor 3: season appears early or late, factor 4: prevalence of mosquitoes and other insects, and factor 5: others. These factors have been mentioned in several studies (e.g. Filiberto et al. 2009; Moser and Satterthwaite 2008) as major environmental impacts of climate change.

(2) Impact on health. Available evidence suggests that climate change has a serious health impact, particularly on older people (Haq, Whitelegg and Kohler 2008; Kovats and Akhtar 2008). As a result, in this study, respondents were asked to answer the following question; "Do you see any impact of these changes on your health?" They were given three choices: yes, no and do not know. Those who said "yes" were additionally asked to name three major impacts from a given five choices: impact 1: high blood pressure, impact 2: cardiovascular disease, impact 3: respiratory problem, impact 4: skin disease, and impact 5: others.

(3) Governmental action. National governments across the world are increasingly engaged in official communication with the United Nations Framework Convention on Climate Change (UNFCCC) and other initiatives, which require an assessment of vulnerability and adaptation capacity (Cimato and Mullan 2010; Jumbe et al. 2008). In order to understand whether or not the respondents were aware of the adaptive measures taken by GoK, they were asked the following question; "Do you know what adaptive measures have been adopted by GoK relating to climate-change effects?" In addition, they were also asked to make their suggestions/opinions as to how climate change effects could be reduced in Kazakhstan.

Climate change and older adults' health: Results and discussion

Public health research suggests that there are a number of environmental threats that disproportionately compromise the health of the older population (Filiberto et al. 2009). Several recent studies indicate that older persons suffer from adverse health effects due to increased heating and cooling, susceptibility to disease, disruptions in the usual supply of food and water and therefore a reduced ability to provide nutritional means for their families (Filiberto et al. 2009; Grundy 2006; Haq, Whitelegg and Kohler 2008; Shuman 2010). This section examines the association between climate change and its impacts on older adults' health from a variety of perspectives.

Results suggest that a large number of respondents are aware of the association between climate change and its health impacts (see Table 2). It shows that most of the respondents are aware of how climate change affects the Earth and also its impact on health. Table 3 clearly demonstrates that older people are more aware of climate-change effects and its impact on their health than relatively younger ones.

Education and climatic effects awareness

The data presented in Table 5 further shows that older adults with a secondary degree are remarkably more aware of the possible effects of climatic change than the tertiary-degree holders. There are differences in the identification of the three major climate-change effects between the groups. Results show that the respondents with secondary education identified deep cold spells in winter, seasons that appear early/late and others as the three dominant effects. The cohort with tertiary education identified hot waves, seasons which appear early/late and the prevalence of mosquitoes and other insects as the three most important effects. On the other hand, like the older adults, relatively younger adults (40–49 years) with a secondary degree are also more aware of the possible effects of climatic change than the tertiary-degree holders (see Table 4). As to the identification of the three major climate-change effects, the younger adults follow the older adults, and the difference in the identification of major effects between secondary and tertiary graduates remains the same as with the older adults. It means that both age groups are generally aware of the effects of climate change. Regarding the impacts on health, older adults with a secondary degree recorded skin disease, cardiovascular disease and respiratory problem as the three major health impacts, while the same cohort with a tertiary-degree noted blood pressure, respiratory problem and cardiovascular disease as the three major health impacts due to climate change effects (see Table 5). This situation is not greatly different between the younger and older adults.

Table 2
Respondents' profile and the state of knowledge on climate change and its health impacts

Characteristics	Number	Percent
Age group		
40–49 years	24	40.0
50 + years	36	60.0
Gender		
Male	37	61.7
Female	23	38.3
Education		
Up to Secondary	35	59.3
Tertiary	24	40.7
Income		
<40,000 Tenge	18	37.5
40,000+ Tenge	30	62.5
Years lived in Kazakhstan		
<40 Years	16	26.7
40+ Years	44	73.3
Awareness about climate change		
Yes	49	81.7
No	11	18.3
Effects due to climate change:		
Hot wave in summer	34	56.7
Deep cold spells in winter	20	33.3
Seasons appear early/late	42	70.0
Prevalence of mosquitoes and other insects	17	28.3
Other than above	12	20.0
Impact on health		
Yes	42	76.4
No	13	23.6
Types of impact*:		
High blood pressure	34	57.0
Cardiovascular disease	24	40.0
Respiratory problem	30	50.0
Skin disease	9	15.0
Other than above	7	12.0

*Multiple responses

Source: Field research.

Regarding the effects of climate change and its health impacts, it reveals that the respondents of both age groups are generally aware of it. The respondents with secondary education were found to be relatively more aware than the tertiary-degree holders. This is because the possible effects on population health of severe environmental degradation and pollution are of considerable concern in Kazakhstan (Kulzhanov and Rechel 2007). The basin of the shrinking Aral Sea is heavily salinated since its feeder rivers are siphoned off in irrigation schemes, and the remaining water is polluted from factories and agriculture. The situation is further aggravated

Table 3
Awareness of effects of climate change and health impacts

	Effects of climate change					Impact on health				
	Hot waves	**Cold spells**	**Seasons appear late/early**	**Prevalence of mosquitoes and insects**	**Others**	**Blood pressure**	**Cardiovascular disease**	**Respiratory problem**	**Skin disease**	**others**
Age cohorts										
40–49 Years	38.2	45.0	38.1	29.4	25.0	23.5	25.0	50.0	33.3	42.9
50+ Years	61.8	55.0	61.9	70.6	75.0	76.5	75.0	50.0	66.7	57.1

Source: Field research.

due to various forms of contamination of the limited supply of fresh water in Kazakhstan (Kulzhanov and Rechel 2007). Kazakhstan has a number of natural breeding grounds for epidemic diseases, including the plague (Comrie 2007), rabbit fever, haemorrhagic fever, tick-borne encephalitis and anthrax (Kulzhanov and Rechel 2007). The decrease in life expectancy in Kazakhstan in the 1990s was largely due to an increase in mortality from cardiovascular diseases (Cockerham et al. 2004). A 2007 WHO report shows the age-standard death rate from ischemic heart disease for males increased from 405 per 100,000 male population in 1989 to 611 in 1996, declining again to 525 in 2005 (compared to 118 in the EU in 2004) (Kulzhanov and Rechel 2007). The study by McKee and Chenet (2002) found that, among other things, poor investigation and treatment of hypertension are major contributing factors in the increase of cardiovascular disease in Kazakhstan. This contextual background made the respondents, irrespective of their level of education, largely associated with the effects of climate change and related health conditions.

Income and years of living in Kazakhstan and awareness of climate change and health effects

The association between income and years of living in Kazakhstan and the desired effects of climate change and its impact on health conformed to the expected relationship. It is, therefore, revealed that the people of the high-income group and those living in Kazakhstan for a long period are more aware of climate change and health effects than those respondents with relatively low income and living there for fewer years (see Tables 4 and 5).

Gender, climate change and health effects

The data show that the Kazakh women are more informed than men regarding climate change and health effects (see Tables 4 and 5). This is possibly due to the effect of the higher life expectancy of females compared to males. According to a 2008 UN database, in Kazakhstan, life expectancy for females and males were 71.2 and 59.0 years respectively (UN 2009). Females' higher life expectancy made them more aware than males of the effects of climate change and its consequences on health.

Governmental action, vulnerability and adaptive capacity to climate change

On the basis of the opinions/comments from interviews of the respondents, this study assessed the association between governmental action and vulnerability and adaptive capacity to climate change in Kazakhstan and found a somewhat mixed relationship. A large number of respondents (56%) expressed their unawareness of any governmental initiatives relating to vulnerability and adaptation. However, those who reported their awareness also voiced their dissatisfaction with GoK for its slow implementation of relevant policies and blamed the public-sector corruption

Table 4
Awareness among younger-age cohort (40–49 years)
about climate-change effects and health impacts

	Effects of climate change					Impact on health				
Characteristics	**Hot waves**	**Cold spells**	**Seasons appear late /early**	**Prevalence of mosqui-toes and insects**	**Others**	**Blood pressure**	**Cardiovascular disease**	**Respiratory problem**	**Skin disease**	**Others**
Gender										
Male	61.5	44.4	56.3	80.0	66.7	62.5	33.3	53.3	66.7	33.3
Female	38.5	55.6	43.8	20.0	33.3	37.5	66.7	46.7	33.3	66.7
Education										
Up to	61.5	33.3	56.3	40.0	66.7	75.0	66.7	46.7	33.3	33.3
Secondary	38.5	66.7	43.8	60.0	33.3	25.0	33.3	53.3	66.7	66.7
Tertiary										
Income										
<40,000 Tenge	36.4	28.6	38.5	20.0	–	50.0	40.0	41.7	50.0	–
>40,000 Tenge	63.6	71.4	61.5	80.0	–	50.0	60.0	58.3	50.0	–
Years lived in Kazakhstan										
<40 years	30.8	33.3	25.0	–	33.3	37.5	33.3	33.3	–	–
40+ years	69.2	66.7	75.0	–	66.7	62.5	66.7	66.7	–	–

Source: Field research.

Table 5
Awareness among older-age cohort (50 years or more)
about climate-change effects and health impacts

	Effects of climate change					Impact on health				
Characteristics	**Hot waves**	**Cold spells**	**Seasons appear late/early**	**Prevalence of mosquitoes and insects**	**Others**	**Blood pressure**	**Cardiovascular disease**	**Respiratory problem**	**Skin disease**	**Others**
Gender										
Male	23.8	18.2	30.8	16.7	44.3	19.2	11.1	20.0	16.7	25.0
Female	76.2	81.8	69.2	83.3	55.6	80.8	88.9	80.0	83.3	75.0
Education										
Up to Secondary	61.9	70.0	64.0	58.3	75.0	68.0	72.2	71.4	83.3	33.3
Tertiary	38.5	30.0	36.0	41.7	25.0	32.0	27.8	28.6	16.7	66.7
Income										
<40,000 Tenge	25.0	28.6	40.0	33.3	40.0	29.4	20.0	45.5	40.0	–
>40,000 Tenge	75.0	71.4	60.0	66.7	60.0	70.6	80.0	54.5	60.0	–
Years lived in Kazakhstan										
<40 years	4.8	27.3	26.9	16.7	22.2	19.2	16.7	26.7	16.7	25.0
40+ years	95.2	72.7	75.1	83.3	77.8	80.8	83.3	73.3	83.3	75.0

Source: Field research.

for this. Corruption in Kazakhstan, as in other Central Asian countries, is rampant (Gleason 1995; Knox 2008). As a result, Kazakhstan consistently scored poorly on the Global Corruption Perceptions Index (CPI) published by Transparency International. The 2009 Global CPI has ranked Kazakhstan 120th among 180 countries surveyed, with an index value of 2.7 (Transparency International 2009). Analyzing the respondents' opinions, it reveals that most of them were unhappy with the inadequate health-care facilities for older adults. Kazakhstan suffers from a dismal performance in the health sector. The main problem with the health-care system since its independence has been very low government funding. For example, in 1998 only 40 % of the requested funds were released by the Ministry of Finance (Piotrowska 2008). In addition, wages in the health-care sector remain low. After a 20 % salary increase in 2004, health-care workers enjoy only about half of the national average wage (Piotrowska 2008). Nevertheless, it is estimated that about 50 % to 60 % of the facilities' expenditures accounted for salaries, while less than 20 % was spent on the actual health care of patients (Piotrowska 2008). This portrays that the health-care system suffers from low investment; hence the poor quality of care.

Health is one of the GoK's priority sectors and has been included in the country's comprehensive strategic policy "Kazakhstan 2030". The policy has identified seven priorities for the country's development (UN 2010): (1) national security, (2) domestic stability and social cohesion, (3) economic growth, (4) health, education and welfare for the citizens of Kazakhstan, (5) energy resources, (6) infrastructure, transport and communications and (7) a professional state. As a consequence, in order to improve the health-care system, the GoK initiated a 5-year long (2005 to 2010) health-care reform and development program, which is currently under implementation. The key objectives outlined in the program are (GoK 2005): the creation of an efficient system of medical care with due consideration of principles of joint responsibility for health protection between an individual and the State with emphasis on primary medical care, the adoption of international principles of medical-care administration, the improvement of maternal and child health care, the improvement of the medical and demographic situation, the decrease of the social-disease morbidity rate and the improvement of the social status and image of medical doctors and technicians. Admittedly, the realization of the objectives still largely remains elusive.

Is the GoK prepared to combat the climate change effects? Kazakhstan has taken an active role in the resolution of global environmental problems from the inception of its independence, including the international process of climate-change prevention. Since 1995, Kazakhstan has been a party to the UNFCCC and ratified the Kyoto Protocol and adopted several legal and institutional mechanisms to combat climate change (ADB 2009; UNDP 2008). Analyzing the 2008 National Human Development Report in Kazakhstan, it is unclear whether GoK has undertaken adequate initiatives to fight against climate change, particularly in the context of human health (UNDP 2008). The lack of governmental action perhaps stems from

the fact that the 2009 "Germanwatch" Global Climate Risk Index (CRI) has ranked Kazakhstan 144th among 148 countries researched, with an index value of 122.33 (Harmeling 2008), making it one of the least affected countries. According to the information provided by "Germanwatch" on Kazakhstan and the resulting evaluation, there is clearly one inconsistency in the interpretation and expression of the evidence-based data. This has happened because the 2009 CRI was calculated on the figures from 2007 on indicators such as number of deaths, number of deaths per 100,000 inhabitants, sum of losses in US dollars in purchasing-power parities and losses in proportion to gross domestic product (Harmeling 2008). There is a possibility that the picture one gets on Kazakhstan from the 2009 CRI is no longer a very accurate portrayal of the reality, as that study was based on just four criteria where the country was least affected. In this study, several determinants have been analyzed other than the above four, and this inclusion and these analyses have helped to arrive at a better representation of the existing situation of climate change and its impacts on older adults' health in Kazakhstan. Whatever the disparity that exists between this study and the 2009 CRI, thus, it makes way for an understanding of the backgrounds of each study and the determinants that dominated them.

Based on the discussions, the results confirm the expected effects of climate change on the older adults' health in Kazakhstan. The results suggest that the older adults of the higher-level income group, who have lived in Kazakhstan for a longer period of time, and females are highly associated with the effects of climate change and related health consequences. Arguably, education is found to be negatively correlated with awareness of climate-change risks as well as older adults' health impacts. This may be attributed to the fact that only a tiny portion of people possesses tertiary education. The results further suggest the inadequate government initiatives to fight against climate change.

Conclusions

The objective of this paper has been to examine the impacts of climate change on older adults' health in Kazakhstan. Available evidence substantiates that climate change largely affects older adults' health. Kazakhstan's poor environmental condition, which is highly sensitive to climate change, largely contributes to exposure to such threats as extreme weathers, temperature raise, drought, and glacier melting. All these have damaging effects – death, exposure to diseases, mental-health problem, forced evacuation and relocation – on older adults' health and thus limit their adaptive capacity to climate change. The results of the study have shown that older adults were mostly aware of climate-change effects and its possible consequences on health as compared to younger adults. Higher climate-change awareness was observed among females and the higher-income group and those who have lived in Kazakhstan for a longer time. The effect of education on climate-change awareness was found to be less evident and more in-depth study is needed to specify the link.

The study also reveals that older people, those who are more aware about climate change, are more likely to have knowledge on health consequences as a result of climate-change effects and have reported significantly higher responses. The results further report on the inadequacy of the governmental measures for climate-change adaptation to interventions, and thus lessening health impacts.

The results of the study have several policy implications. First, in order to achieve one of the articulated "Kazakhstan 2030" policy goals (i.e., health, education and welfare for the citizens of Kazakhstan), GoK has planned to reform the development of health care. Therefore, adequate governmental actions are needed to bolster the smooth implementation of the policy. Second, for taking special health care to older adults, more elderly-friendly sanatoriums need to be established across the country. Third, adequate government investment is a pre-requisite to improve the quality of care. This greatly depends on the government's political will whether or not to modernize its age-old health-care facility. Fourth, various policy programs are needed to inform and educate citizens, preferably the older adults, about the effects of climate change on health and to familiarize them with the adaptation techniques. This will be an enormous task, which necessitates public-private partnerships for its cost-effective and cost-efficient implementation.

There are several limitations to this study. First, the field study of this research was conducted only in five micro-districts in the Almaty region among 16 *oblasts* (regions) in Kazakhstan; therefore, the empirical results presented here are not representative but indicative in nature. Second, the respondents were asked subjective questions to understand their awareness of the effects of climate change and its impact on health without knowing whether or not the respondents had been suffering from the climatic diseases; more accurate and objective answers would have been recorded if the survey was conducted only among those people who had been affected by climatic health trauma. Third, the sample size of the study was relatively small, and of those who were surveyed, the number of older adults was even fewer. This consequently constricted diverse answers, opinions and suggestions from more elderly respondents.

Three key areas which warrant further research have been identified: (1) the attribution of glacier-melting-related disasters to climate change: because no such well-known study on global attribution is yet planned; (2) regional analysis: as the understanding of the human impact on climate change in the Central Asian region is very limited, but it is also significant to steer adaptation interventions; and (3) an estimate of short-term and long-term economic losses due to adverse health conditions both at regional and global levels.

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